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ABSTRACT

Building a partnership between school and home can be an effective way of providing for a better education for children. This booklet is concerned with educating students in mathematics and science. The booklet stresses the use of calculators and computers throughout courses from kindergarten to 12th grade, especially in mathematics and science classes. It contains sections on: (1) why minority parents are concerned; (2) what parents should know about mathematics and science classes; (3) the parent's role in monitoring homework; (4) extra activities in science and mathematics; (5) helping children prepare for tests; and (6) home projects for parents and younger children. (TW)

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Get Into The Equation

Math and Science Parents and Children

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A parent's help can make a difference in a child's success in school and open the door to opportunity.

Partners in Education

Many of us, as we were growing up, heard from parents and grandparents about how important education is. They saw it as a way out of poverty, of back-breaking work, of a dead-end life. Education can be just as important for our children. Science and mathematics are shaping the future; studying these subjects prepares young people for a place in that future. Helping our children negotiate the school system will help them get all they can out of education. Building a partnership between school and home is an effective way to provide for our children's future.

Acknowledgments

The spirit of partnership guided the many people who so willingly helped us to prepare this booklet, a resource intended especially for black, Mexican American, Puerto Rican, and Native American parents of school-age children. We give special thanks to Mary Morrison and Treopia Washington for helping to coordinate the advisory board meetings, find materials for this publication, and field test the early draft. Several books from the College Board's Educational EQuality Project served as the basis for our work: *Academic Preparation for College*, *Academic Preparation in Mathematics* and *Academic Preparation in Science*.

This publication would not have been possible without the help of the advisory board members, who read these College Board books and told us what, in all this material, parents especially need to know about mathematics and science education in elementary and secondary schools. Advisory board members included Deanna Beane, National Urban Coalition, Washington, D.C.; Emma Benning, president of the Jack and Jill Foundation of America, Shaker Heights, Ohio; Hilda Crespo, ASPIRA of America, Washington, D.C.; Floyd Downs, Hillsdale High School, San Mateo, California; Charlotte Dryden, parent in Columbia, Maryland; Martin Johnson, professor of mathematics education, University of Maryland, College Park; J. Arthur Jones, Decision Information Systems Corporation, Washington, D.C.; Deborah Kendig, member, Board of Education, Howard County Public Schools, Maryland; Gerald Kulm, Office of Science and Technology Education, American Association for the Advancement of Science; and Julia Richie, League of Women Voters, Birmingham, Michigan.

We are grateful to the National Coalition of Chapter I parents and the Atlanta, Georgia, Minority Women in Science Network for allowing us to field test a draft of this publication at their meetings. Pictures were provided by the National Air and Space Museum; the Association of Science-Technology Centers; Museum of Science, Boston; Discovery Place, Charlotte, North Carolina; the Science Museum of Connecticut, Hartford; Jefferson Junior High School, Washington, D.C.; New York Urban League; and Sharon Farmer, Lou Fernandez, Michael Kagan, and Lynn Pelham, photographers.

Shirley M. Malcom, Head, and Yolanda S. George, Co-director, Linkages Project, Office of Opportunities in Science
American Association for the Advancement of Science

James Herbert, Executive Director for Academic Affairs, The College Board

September 1987

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What Students Need

Employers say that the skills and classes needed by high school students going directly into the world of work are the same skills and classes needed by students going directly to college. The **skills** are not only *reading, writing,* and *mathematics* but also include *speaking, listening, reasoning, knowing how to study,* and *knowing how to use computers.* All students need to take **classes** in these subjects:

- English
- mathematics
- science
- social studies
- the arts
- foreign language

In this booklet we are particularly concerned with educating students in *mathematics* and *science.* And we feel that it is crucial for students to have a working knowledge of *calculators* and *computers;* computers should be integrated into courses from kindergarten to the twelfth grade—especially in mathematics and science courses. This publication is useful for all parents, but we are particularly concerned with reaching the parents of black, Mexican American, Puerto Rican, and Native American children.

Students in a biology lab class discover exciting things under a microscope.

Why Minority Parents Are Concerned

At this point you may be wondering why, as a black, Mexican American, Puerto Rican, or Native American parent, you should be concerned about the mathematics, science, and computer education of your child. Here are some of the major reasons:

Getting a job

- First, your child will have a much better chance of finding a job if he or she has a good background in mathematics and science and experience using computers.*

  For example, the overall unemployment rate for black adults (ages 25-45) is around 14-15 percent, but the unemployment rate for black scientists and engineers is only 2.5 percent. This means that black adults without mathematics, science, and computer skills are 6 to 7 times more likely to be unemployed than those with these skills.

  The overall unemployment rate for Hispanic adults is 11-12 percent, but the unemployment rate of Hispanic scientists and engineers is only 2.1 percent.

  Unemployment figures for Native Americans are inexact but they reveal the same pattern.

- Second, you want your child to be qualified for a good job. In the future, many of the best jobs will require skills in mathematics and science and a working knowledge of computers.

  Ebony magazine (October 1986) listed science, engineering, and computer professions among the most promising careers for blacks. Many of the other promising careers require a strong background in mathematics. The top ten careers were:

  1. Public administration
  2. Health administration
  3. Bank management
  4. Military officer
  5. Financial planning
  6. Teaching
  7. Engineering
  8. Marketing research analysis
  9. Earth and marine science
  10. Computer professions

  Although there will be more jobs in the service and manufacturing areas than at present, these jobs will clearly involve the use of computer-driven machines and mathematical skills. In the twenty-first century even secretarial jobs will require more knowledge of computers and automated machines.

- Third, with skills in mathematics and science, your child can earn more money.**

  For example, the typical income for a Hispanic family of four is about $19,000. The average annual salary of Hispanic scientists and engineers is $33,100.

Capri Martinez, a Mexican American, is a computer information specialist with a Pennsylvania chemical manufacturing firm.

The typical income for a black family of four is less than $17,000. The average salary for black scientists and engineers, not including other working family members, is $32,500.

The pattern is similar for Native American families, although the data are inexact.

Mathematics, science, and computer education for minority children can eventually lead to their finding and keeping better jobs. This can break the cycle of unemployment, underemployment, and poverty in black, Mexican American, Puerto Rican, and Native American communities.

Improving the quality of life

You may not realize it, but mathematics, science, and computers help to improve the way we live in small ways as well as in some major areas. With the proper training in these areas your child can help to improve the quality of life for all people.

- Years ago, would you have dreamed that a machine could cook your food in 5 or 10 minutes, and that a machine could record television shows for you when you are not at home or watching a show on another channel?
- Years ago, could you have imagined that metals and plastics would be used to make artificial hearts, legs, arms, and other body parts?

Making wise decisions

We know that not all minority students are interested in careers in mathematics, science, or engineering.

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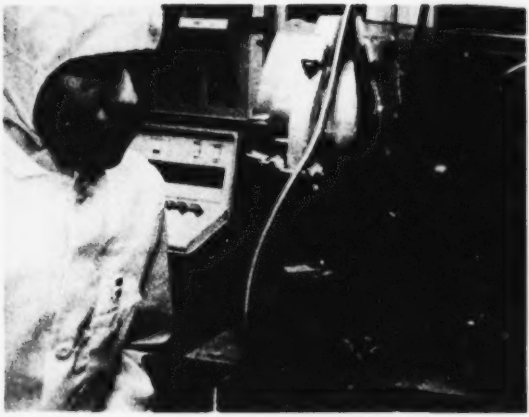
*Data for unemployment are taken from the 1986 *Current Population Survey* of the U.S. Bureau of Labor Statistics (202-523-1944).

**Data on median family income are for 1985 and are found in *Money, Income, and Poverty: Status of Families and Persons in the United States* (series P-60:154, 202-763-5060). Figures for unemployment rates and average salaries for scientists are from *Women and Minorities in Science and Engineering* (National Science Foundation, 86-301, 1986).



Guadalupe Fortuno, a Puerto Rican, is a physicist in a New York computer firm.

But the skills that they get by taking advanced mathematics and science courses will be useful in making informed decisions in our rapidly changing world.

- Working in a hospital, for example, you have to understand enough about implants that dispense insulin, or kidney transplants, or CAT scans to be able to make life-and-death decisions.
- Politics too, is sometimes close to science. Issues—such as unsafe job conditions, chemical spills, air pollution, and AIDS—confront us daily to consider, to work for or against, and to vote on.
- Understanding newspaper items about such quantitative matters as interest rates, inflation, or tax rates helps when you are deciding about buying a car or house or doing your income tax.

A new attitude

You can help your child to obtain a firm foundation in mathematics and science, no matter how much schooling you have had or how much you know about mathematics, science, and computers. Maybe you felt these subjects were too forbidding or just weren't for you. Your child can do well in school and have a positive attitude about learning mathematics and science. The key is for you to show an interest in your child's mathematics, science, and computer courses.

There are many ways that you can show your interest, whether mathematics, science, and computers scare you or appeal to you—no matter whether you did well in these subjects when you were in school. The rest of this booklet gives you some facts and tips on how you can help your child do better in mathematics, science, and computer classes.

What Every Parent Should Know about Mathematics and Science Classes

Given support and encouragement, *all* students can perform well in mathematics and science courses. You can be a big help to your child when you know some of these general facts. They will be useful in talking with your child and with the teachers and counselors at school.

- All students should take mathematics and science courses every year. An understanding of mathematics and science builds up over a period of time. Put another way: "If you don't use it, you'll lose it." Mathematics skills disappear very quickly without practice.
- Science depends on mathematics. For example, in the science of genetics, mathematical probability is used to determine if children will have their mother's eye color or their father's height.
- Students learn science best through hands-on experiences, by handling physical objects, doing laboratory experiments, exploring things in the field, and

Teachers care about raising their students' interest in science. What's in those beakers?

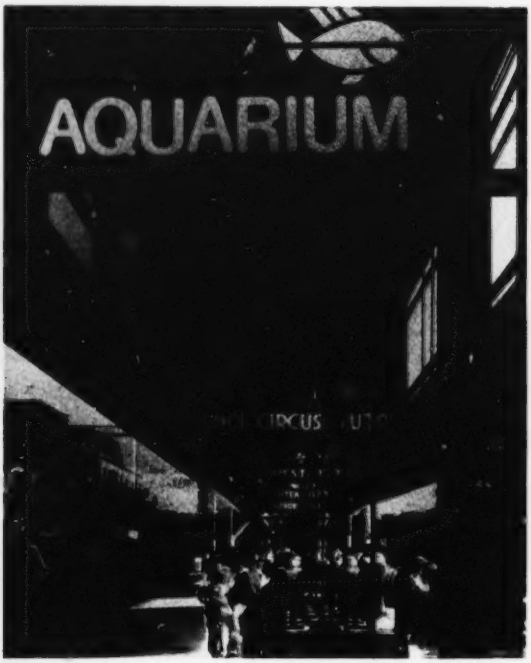
Younger students in their school's computer lab learn to feel at ease with these important tools for handling information fast.

asking questions about what they see in laboratories and on field trips.

- Learning mathematics should involve more than moving numbers around. Students should learn to use mathematics to analyze and understand situations they encounter in their daily lives.
- Many teachers in elementary school and middle or junior high school group students according to ability. In high school, different courses are often given for students who perform differently on tests. It is important for you to be aware of how teachers and schools form these groups. The curriculum of classes at different track levels varies in the instructional content made available to the students. You should make sure that your child is not placed in dead-end courses. If you discover your child is in a low-track class, find out what is required to move to a higher-level group for students who are going to college or to a good job after high school. Your child may need to go to summer school or participate in a tutoring program to get into such classes. Find out from your school what resources are available. Encourage your child to take advantage of them. It undoubtedly will mean more work, but it's worth the effort.
- Calculators, computers, videotapes, and videodiscs are useful aids in studying, particularly in mathematics and science courses.
- Computers are useful in understanding how to organize information and solve problems, not only in mathematics and science but also in the social sciences, languages, and the arts. You should make sure your child learns how to solve problems, use computer packages, and write computer programs, not just do drill and practice or play games on a computer.

At the elementary school level

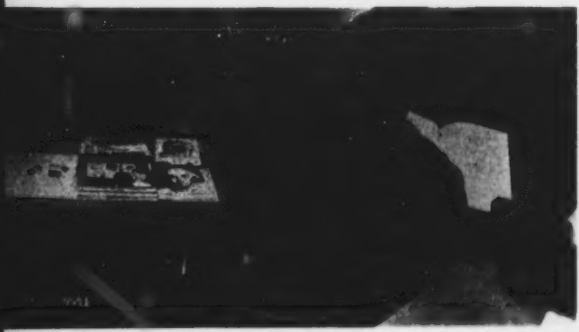
- Your child's feelings and interest in mathematics and science are formed in elementary school. You can help your child develop good feelings—fun, success, excitement, discovery, mastery—around these subjects.
- Mathematics is more than just adding, subtracting, multiplying, and dividing; mathematics also involves problem solving. Problem solving, among other things, means knowing *when* to add, subtract, multiply, or divide. Instead of just filling in sheets of homework drill, your child can use mathematics creatively and apply new skills in practical situations.
- At this level it is important that mathematics and science are a part of your child's everyday experiences. For example, you can ask your child to count out the forks at dinnertime, measure the ingredients in recipes or halve a recipe, build and fix a model airplane. There are many ways to reinforce the science and mathematics lessons and principles that children are learning in school.



Discovery Place, in Charlotte, North Carolina, looks like a great place to get excited about and involved in science. Here the whole class takes a field trip, but parents can take their children, too.

At the middle school or junior high school level

- Mathematics should prepare students for algebra and the rest of high school mathematics, not just review elementary school arithmetic.
- Mathematics classes should contain some algebra and geometry topics.
- Students should gather scientific information through laboratory experiments, field trips, and library work and organize it in charts and graphs and by other means.



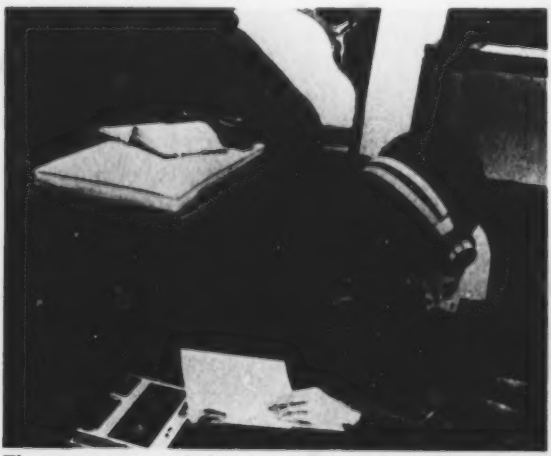
Learn about all the careers open in science and math—it's awesome.

- Many children make decisions about careers in junior high school or middle school. Make sure your children are prepared to make informed decisions, by locating information about different careers and sharing it with your children. Visit work places; suggest to the teacher that parents in some professions come to school to explain their jobs to the children.
- Be aware that high school tracking in mathematics and science courses is based on middle or junior high school grades and sometimes on test scores. This is the time for students to try to do well in mathematics, not to let up or coast along.

At the high school level

- Decisions about courses that are made in high school will influence a child's future in college and in a career. Talk with your children about the courses they choose—they might be deciding only on the basis of a friend's preference or who is the most popular teacher.
- In most places algebra opens the door to advanced mathematics. Your child should take algebra in the ninth grade—or in the tenth grade, at the latest.

- Algebra and the high school mathematics courses that come after it are the key to careers in mathematics and science fields. Scientific and engineering careers, particularly in chemistry- and physics-related fields, involve using a lot of mathematics every day.
- At the high school level your child should be involved in mathematics courses every year. Besides algebra, most high schools offer courses in geometry, trigonometry, statistics, functions, calculus, and other advanced mathematics. Continuous study of mathematics will lead to more and more sophistication in this area. Students who do not take mathematics in their last year of high school often have trouble in college.
- Make sure that your child is not repeating the same mathematics course every year with a slightly different name.
- Although they might count toward high school graduation, courses such as general mathematics, business mathematics, and arithmetic generally do not satisfy college admissions requirements. These courses also are usually not enough to help a student going to college or even directly into the job market after high school. If such courses are recommended for your child, discuss the implications of taking such courses with your child and with the teachers. It may be better for your child to avoid these classes and to move ahead in the regular pre-college mathematics sequence, getting extra help, if needed, from tutors or special materials and support from the teacher.



The wrong way to do homework: slumped over, music in your ears, and no chair, desk, or lamp.

- Science courses should involve collecting and organizing data and not just memorizing terms. In working with such data students should use what they are learning in mathematics courses. Students who plan to go to college should take a set of courses that usually includes biology, chemistry, and physics.
- Remember, the point is not just for your child to get into college but to do well there. Often this means taking more high school mathematics and science courses than a college's minimum admission requirements.

The Parent's Role in Monitoring Homework

Showing your interest in your child's homework gives him or her the message that doing well in mathematics, science, and computer courses is very important and that you are seriously concerned about the child's progress.

Homework is easier and students learn better when they do their studying in a quiet place, without distractions. It really matters.

- Establish a regular study time and provide a quiet space for study, away from the distractions of the telephone, television, and radio.
- Every day ask your child what he or she did in mathematics, science, and computer class that day. Ask leading questions—for example, "What did you learn in your science class today?" Allow time for the child to explain and continue to show interest and support.
- Check every day to make sure your child is completing homework assignments. Ask to see the completed homework and any tests or projects that have been graded and returned.

- Offer to read questions from the book for your child to answer. You don't have to know all the answers, but just talking about the assignment helps.
- At least once a week, ask your child if he or she is having any difficulties with mathematics, science, and computer classes. If so and if you cannot help, talk to the teacher or find a friend or relative who can help. Sometimes a child may need a tutor.
- Check with your child's school to see if the school district has a "homework hotline." In many parts of the country schools have set up telephone hotlines to assist students with science and mathematics homework.

Extra Activities in Mathematics and Science

Learning that takes place in the classroom should be reinforced by activities or projects that take place after school—in the home and in the community—as well as at school. You can identify extra activities in mathematics, science, and computer use, and encourage your child to participate.

- Encourage your child to join science, mathematics, or computer clubs, and participate in science fairs at school.

Activities for students—such as playing with working models of inventions or exploring how to use a computer—are often offered free or for a small fee by:

- businesses and local government agencies
- science museums, zoos, and botanical gardens
- colleges and universities

At the Smithsonian's National Air and Space Museum in Washington, D.C., visitors are close to space capsules and to the Wright brothers' early flying machine. They see what can be done using mathematics and science.

Workshops and tutoring in science, mathematics, and computers may also be provided by community-based organizations such as Girls and Boys Clubs, Girl Scouts and Boy Scouts, National Urban League, NAACP, ASPIRA, National Urban Coalition, National Council of Negro Women, A.G. Bell Association for the Deaf, Jack and Jill, Inc., Native American groups, sororities and fraternities, and local churches.

You can help your child to expand his or her mathematics, science, and computer activities at home.

- At least once a month, try to take a family field trip to the zoo, science museum, botanical garden, aquarium, or some outdoor setting. Visit the library to find books on science and mathematics topics. Many libraries have computers that you can sign up to use.
- For birthdays, holidays, and other special occasions, give your child books about mathematics, science, and computers; subscriptions to science magazines; mathematical games, puzzles, and toys; calculators; and scientific games, kits, and posters. You can find such items in toy shops, bookstores, department stores, and museum gift shops at reasonable prices.

June Bacon-Bercey, a black, is a meteorologist, and it's her time to go in front of the camera.

- At least once a week, try to watch a science-related television show with your child. Science programs that are currently shown on regular or public television stations include "Square One," the "Knowzone," "3-2-1-Contact," "Newton's Apple," "Nova," "Living Planet," and National Geographic specials. If you have cable television, you can watch programs that are featured on Science and Technology Week, for example, and "How About," a show that features Mr. Wizard.
- Point out and discuss with your child science stories on television news shows and in newspapers.

Helping Your Child Prepare for Tests

While your child is in school, he or she will take many tests, both those that the teacher makes and standardized tests. Standardized tests determine a student's strengths and weaknesses in relation to other children and may help to point out areas where a student needs help. There are several things that you as a parent can do to help your child have successful test-taking experiences.

- Make sure that your child is in school during the testing sessions. Do not schedule any appointments for your child, such as doctor or dental visits, on test dates.
- See that your child is well-rested and eats a good breakfast before the test.
- Encourage your child to study regularly, rather than just the night before a test.
- Encourage your child to listen carefully to all test-taking directions given by teachers or other people who are giving the test. Tell your child if he or she does not understand the directions, to ask the person giving the test to explain the directions again.
- Keep track of your child's test scores and find out what the scores mean. If you do not understand the scores, ask the teacher, counselor, or a knowledgeable friend or relative to help you figure out what the scores mean. Discuss the scores with your child.
- If there are major differences between a child's standardized test scores and school grades, find out why. Sometimes standardized tests reveal talent and ability that teachers overlook. Sometimes students do not do well on such tests because of poor test-taking skills or test anxiety. If your child is nervous at test time, find out from the teacher what you can do to help your child feel better about taking tests.

Counselors and teachers can be a great help, as students get together to discuss what they've learned.

In addition to required tests, there are college entrance tests, which you must ask about. Many colleges and universities use these tests in making decisions about college admissions and placement. Students may not be eligible to participate in collegiate athletics if they don't achieve satisfactory scores on their college entrance tests and have good grades in school. In some instances you may need to pay a fee for your child to take college entrance tests.

There are several things you ought to know about these tests.

- In the fall of the eleventh and twelfth grades, your child should let the teacher or guidance counselor know that he or she is interested in taking these tests. Teachers or guidance counselors get the registration packets for college entrance tests in the fall. Registration deadlines are five to six weeks before the tests are to be taken.
- Students can take the Preliminary Scholastic Aptitude Test/National Merit Scholarship Qualifying Test (PSAT/NMSQT) in October of both their sophomore and junior years in high school. Make sure that your child at least takes this test in his or her junior year. Students who do very well on the test in their junior year may be eligible for scholarships to college.
- Through 1989, for example, Hispanic high school juniors taking the PSAT/NMSQT will be automatically eligible for the College Board's National Hispanic Scholar Awards Program. This program, which is funded by the Andrew W. Mellon Foundation, provides one-year scholarships in the amount of $1,500 and honorable mention awards of $100 to Hispanic students.

Classroom teaching, homework, and extra activities outside of school all help develop students' confidence and skill. When test time comes, they'll be ready.

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- Similarly, black high school juniors taking the PSAT/NMSQT may become eligible for the National Achievement Scholarship Program for Outstanding Negro Students.
- Be sure that your child takes the Scholastic Aptitude Test (SAT) or the American College Testing (ACT) Program Assessment in the junior or senior year of high school.
- When your child registers for the PSAT/NMSQT or the SAT be sure that he or she signs up to participate in the Student Search Service. The Student Search Service furnishes students' names to colleges that want to tell interested high school students about programs and financial aid opportunities. A variety of public and private financial aid is available that puts college within reach of many families who think they cannot afford it.

Some colleges and universities and community-based organizations offer workshops that help students prepare for the national standardized tests. Some school districts are also beginning to offer test-taking skills workshops. If you don't know whether your district offers this assistance, *ask*. If your district doesn't offer test-taking skills workshops, ask about the nearest location where the sessions are offered.

You can get some books from the local library or buy some books in department stores and bookstores that will help your child prepare for national tests. These books contain practice questions and answers. Your child should use a timer while doing the questions in the books and develop strategies for moving quickly and carefully through the test. But remember: short-term preparation for taking a particular standardized test is no substitute for regular study in mathematics and science courses.

Home Projects for Parents and Younger Children

- Float objects, such as straws, in plain water and in salt water. Because the density of the salt water is greater, objects that sink in plain water float in salt water.
- Following the directions on a box of food coloring, teach your child about colors. You might prepare the different colors and arrange them in glass jars. Then dye objects such as macaroni or paper to make them all the colors of the rainbow. By combining the three primary colors—red, yellow, and blue—you can produce every color.

A big selection of scientific toys, models, games, and puzzles. They make great gifts, and they let students have fun and learn at the same time.

- Magnets pick up things that are made of metal. Have your child make a list of things in the kitchen or other rooms of the house that might attract a magnet. When the child has completed the list, let him or her see if all the objects are attracted by the magnet.
- Using a ruler, draw a cross in the middle of a piece of thin cardboard. The legs of the cross should be about 2 inches long and ½ inch wide. Cut the cross away, leaving the card intact. Place the card at right angles straight up in front of a picture of a building. Look down through the cross at the picture; the picture will appear to stand out in three dimensions.
- Get some blocks and stack three on the bottom layer, two on the next, and one on the top. Ask your child, "How many blocks are there? How many blocks does it take to make a tower 10 blocks high?"

Home and School

The most important thing you can do, however, is to believe in your children. Encourage them to enjoy and stick with mathematics and science. Native American, Puerto Rican, Mexican American, and black students *are* succeeding in these fields—and your children can do it, too!

Resources

For information on after-school or summer mathematics and science programs in your local area write to:

National Action Council for Minorities in Engineering, 3 West 35th Street, New York, New York 10001

American Association for the Advancement of Science, Office of Opportunities in Science, 1333 H Street NW, Washington, D.C. 20005

For information on your nearest science museum write to:

Association of Science Technology Centers, 1413 K Street NW, Tenth Floor, Washington, D.C. 20013

Community-based organizations that have science programs:

American Association of Blacks in Energy (AABE), 1220 L Street NW, Suite 605, Washington, D.C. 20005

American Indian Science and Engineering Society (AISES), 1310 College Avenue, Suite 1220, Boulder, Colorado 80302

Association of Puerto Ricans in Science and Engineering (APRSE), P.O. Box 1725, Washington, D.C. 20013

ASPIRA of America, 1112 16th Street NW, Washington, D.C. 20036

Girls Clubs of America, Inc., 205 Lexington Avenue, New York, New York 10016

Jack and Jill Foundation of America, P.O. Box 3606, Chattanooga, Tennessee 37404

Math/Science Network, c/o Mills College, Oakland, California 94613

Minority Women in Science Network, AAAS, 1333 H Street NW, Washington, D.C. 20005

National Urban Coalition, 1220 G Street NW, Washington, D.C. 20005

National Urban League, 500 East 62nd Street, New York, New York 10021

National Council of Negro Women, Inc., 701 N. Fairfax Street, Alexandria, Virginia 22314

Native American Science Education Association, 1333 H Street NW, Washington, D.C. 20005

For free mathematics and science books, posters, and listings write to:

"Career Opportunities in Science," AAAS, Office of Opportunities in Science, 1333 H Street NW, Washington, D.C. 20005

"Home Team Learning Activities," American Federation of Teachers, Public Relations, 555 New Jersey Avenue NW, Washington, D.C. 20001

"Plain Talk about Tests," National PTA, 700 North Rush Street, Chicago, Illinois 60611 (send self-addressed, business-size, stamped envelope)

Poster of 20 famous black American scientists, B&C Associates, Inc., P.O. Box 2636, High Point, North Carolina 27260

For subscriptions to mathematics magazines:

Dynamath (grades 5-6), $9.90 from Scholastic Inc., P.O. Box 644, Lynnhurst, New Jersey 07071

Scholastic Math (grades 7-9), $10.50 from Scholastic Inc., P.O. Box 644, Lynnhurst, New Jersey 07071

For subscriptions to science magazines:

The Electric Company Magazine, 200 Watt Street, P.O. Box 51177, Boulder, Colorado 80321, $10.95

3-2-1 Contact, P.O. Box 51177, Boulder, Colorado 80321, $11.95

World, National Geographic Society, 1145 17th Street NW, Washington, D.C. 20036

For information on college entrance tests:

Taking the SAT, College Board ATP, CN 6200, Princeton, New Jersey 08541

ACT Registration, Box 414, Iowa City, Iowa 52234

For a free copy of the Educational EQuality Project's book *Academic Preparation for College*, write to the Office of Academic Affairs, The College Board, 45 Columbus Avenue, New York, New York 10023-6992.

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